FOR THE PROTECTION OF ANIMALS FROM VIVISECTION.

THE

FUTILITY

OF EXPERIMENTS WITH DRUGS ON ANIMALS.

BY

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THE FUTILITY OF EXPERIMENTS WITH DRUGS ON ANIMALS.

In Mr. Erichsen's Annual Report and Return showing the number of experiments performed upon living animals during the year 1887, under licenses granted under the Act 39 & 40 Vict., c. 77, we find the following statement:—

"The Therapeutical experiments are 280 in number. These have been made, in the case of new drugs, either with the view of justifying the further extension of such remedies to man, or of enlarging their present sphere of usefulness; in the case of some of the old drugs, with the view of inquiring whether their action is such as to justify their continued administration for the purposes for which they have hitherto been used. The experiments consisted chiefly of hypodermic injections, and were mostly of a painless character."

We may divide these remarks into those which apply to *New Drugs*, and those which refer to *Old ones*.

Of the *New Drugs*, the Inspector says that the experiments have been directed with the view of—

(α) Justifying their further extension to man, or

(β) Enlarging their present sphere of usefulness.

With respect to the *Old Drugs*, he says that the experiments have been conducted to ascertain whether their action justifies their continued use for the old purposes.

He adds that the experiments were mostly performed by inserting the drugs in solution under the skin, as morphia and other drugs are frequently injected in medical practice; he

further states that these injections were mostly painless. Whether this latter statement is the fact or not will be shown in the course of our inquiry.

It will be found very instructive and interesting to bestow careful attention to what is really involved in these apparently matter-of-fact remarks, and to endeavour to ascertain what we are committed to, if we accept these investigations at the value herein sought to be claimed for them. We propose to show by a careful examination of the works of the most eminent experimental physiologists and medical writers, and for the most part in the words of one set of experimenters commenting on the proceedings and conclusions of another set—what is the real scientific value to be attached to

1st. The physiological action of drugs used in medicine when tested upon various animals.

2nd. The physiological action of a drug as compared with its clinical action.

The reader will be in a position to judge for himself how far it is safe and wise to extend to man any sort of medicine upon this system of arriving at the nature of its action. He will be enabled also to judge how far it is wise to discard a medicine which has proved itself of definite clinical value, because it has failed to pass satisfactorily the ordeal of an examination in physiology!

The method adopted in these pages will be to take the principal drugs and chemicals which are used in the practice of medicine, and compare and contrast their action on the different species of animals upon which they have been tried, both with each other, and upon man. Some very remarkable differences will be found to exist in these effects, differences which will serve to illustrate the contention that this method of investigating the properties of medicines is both misleading and unscientific. It has long been a familiar fact to those who protest against the practices of vivisection, that there are

several drugs which are deadly poisons to man which are eaten with impunity by goats, rabbits, and other mammals; for instance, goats eat hemlock, and take no harm; rabbits devour belladonna with impunity; pigeons are not affected by doses of opium strong enough to kill a man. These and a few other stock illustrations are well known to all who take an interest in the vivisection controversy, and the physiologists, like Dr. Lauder-Brunton, have endeavoured to explain away the difficulties connected with the diverse action of these poisons in men and animals.

It has been considered advisable to bring together the whole of the materia medica in which these different actions are most clearly shown, and to present the evidence of eminent authorities, both English and foreign, which tends to show how vain a thing it is to expect to find out remedies for our own diseases by experiments upon animals which are not constituted as we are, and which frequently find their food in things which would be fatal to mankind.

Medical progress does not, and cannot, lie this way. It was not thus that Paracelsus blessed the world with his opiates and his mercurials; not thus that the Jesuits discovered the virtues of Cinchona bark with its active principle, quinine; not thus that Simpson brought us the heavenly boon of chloroform; not thus that any one good thing in the armamentaria of the physicians has found its way thither. Mr. Lawson Tait has most ably done for the surgical what I hope to do for the medical side of this important question; and I shall confine my attention therefore to the consideration of the therapeutical value of experiments with drugs upon animals and men. The drugs will be taken in the alphabetical order of their common English names for facility of reference, and the Latin or pharmacopœia names will be appended; then a short explanation of their action upon animals and human beings will follow, with the opinions of the experimenters in parallel columns.

Aconite (*P. B.*)—This plant is known by country people as Monk's-hood. Dr. Ringer says:—"Perhaps no drug is more valuable than aconite." An alkaloid is prepared from it which is termed *aconitia.* It is one of the deadliest of the vegetable poisons; yet Linnæus says that the plant, when dried, is eaten by horses without injury (*Pratt's Flowering Plants of Great Britain*, Vol. 1, p. 46). Different experimental pharmacologists have arrived at quite diverse conclusions as to the action of aconitia upon the nervous system of the various animals which they have poisoned with this drug. Some of their cruel experiments with the alkaloid, which causes the most irritating and burning effects, are termed by the operators "very complete and beautiful investigations." Rabbits were caused by it "to jump vertically in a very peculiar manner, and often to squeal piteously," then to fall into "severe convulsions." Dogs, however, remained without a quiver, but horses were convulsed. (*St. Thomas's Hospital Reports*, V.)

Achscharumow says that in frogs aconitia produces at first a reduction in the number of the heart's pulsations, then an increase in the rapidity of its action. — (*Reichert's Archiv*, 1866, p. 255.)

Achscharumow argues that the slowing of the pulse during the early stage of aconite-poisoning is due to stimulation of the inhibiting centres in the medulla oblongata.—(P. 272.)

The most diverse conclusions have been arrived at by different vivisectors as to the action of

Lauder-Brunton says: "The heart in the frog is first quickened and then slowed. In man or mammals there is first slowness of the pulse, but shortly before death it may become more rapid."—(*Pharmacology*, p. 759.)

Böhm and Wartmau repudiate this conclusion.—(*Loc. cit.*, p. 266.)

"Later investigations have, however, clearly shown that some fallacy exists in the studies of Achscharumow." — (*Wood*, p. 174.)

Lauder-Brunton says (p. 750): "The motor centres of the spinal cord, and the respiratory and

aconitia upon the nervous system. Achscharumow says that the spinal cord is not affected.—(*Wood*, p. 174.)

vasomotor centres in the medulla appear first to be slightly stimulated, so that clonic convulsions may occur, the reflex power of the cord is diminished."

Ringer and Murrell (*Journal of Physiology*, I., Nos. 4 and 5) deny the accuracy of the delicate experiments of Liégeois and Hottot.

Experiments by Mackenzie upon frogs have yielded apparently contrary results to those of Böhm and Wartmann as to the effect of aconite upon these animals.—(*Wood*, *Therapeutics*, p. 177.)

MM. Gréhaul and Duquesnel, writing in *L'Union Pharmaceutique*, August, 1871, communicated to the French Academy some experiments upon frogs with aconitia. Wood says (p. 177) "that their results are so strikingly different from those of other experimenters as to indicate the existence of some fallacy."

Dr. Ringer says (*Hand Book of Therapeutics*, p. 397, 5th Edition) that "very diverse statements are made concerning its action on the nervous system."

The literature of the subject teems with the opposed statements of the physiologists on the action of aconite upon the animals and men experimented upon with this poison. Yet Dr. Laudèr-Brunton says that our objection to the value of such experiments is due to ignorance. "Almost all our *exact knowledge of the action of drugs on the various organs of the body, as well as the physiological functions of these organisms themselves, has been obtained by experiments upon animals.*"

Ignorance cannot be Dr. Brunton's excuse for this astounding statement!

Alcohol.—Alcohol is used in medicine as a cordial stimulant. Physiologists are much divided in opinion as to the way it acts upon man and animals. Dr. Zimmerburg, experimenting upon cats, said it *lowered the pulse rate*. Dr. Wood

says that he thinks "there must be some fallacy underlying" these experiments. There generally is! Our daily experience of the influence of alcohol upon the pulse proves that in this instance there must be a fallacy. The action of various kinds of alcohol as brandy, whisky, rum, wine, and beer is physiologically different. Dr. Stillé says (p. 1,347): "It is one of the unfounded claims of science that chemicals of apparently the same composition are identical in their action; for experience daily shows that physiological effects cannot be predicted upon chemical grounds alone. The action of whisky, both immediate and remote, differs in many respects from that of brandy."

Böcker says that alcohol *lessens* the amount of carbonic acid gas exhaled. — (Claude Bernard, *Journal de Pharmacie*, Com. xv., 3rd series, 1849.)

Böcker also experimentally determined that alcohol lessens the excretion of urea.

MM. Lallemand, Duvoy, and Perrin assert that alcohol escapes unchanged from the body.

Dr. E. Smith found that alcohol *increases* the elimination of the gas.—(*Wood*, p. 121.)

Parkes and Wollowicz affirm that their experiments gave an exactly contrary result.—(*Wood*, p. 122.)

Baudot (*L'Union Medicale*, 1863), seriously questions these results, and declares that after twenty experiments he finds that the alcohol eliminated by the kidneys practically amounts to nothing.

Dr. Ringer says:—"Observations on the influence of alcohol on the blood and organs have yielded contradictory results, the most recent and elaborate investigations of Parkes and Wollowicz clashing in most particulars with those of previous experimenters."—(*Therapeutics*, p. 274, 5th Ed.)

Dr. Ringer (himself a well-known experimenter) admits that "as physiology fails to guide our steps amid these

conflicting statements 'we must rely solely on experience.'" —(*Therapeutics*, p. 277, 5th Ed.)

Alkalies.—Such as *Bicarbonate of Soda*, *Bicarbonate of Potash*, *Citrate of Potash*, *Acetate of Potash*, and other well-known drugs. Writing of these, Dr. Ringer says:—"We may here introduce a short summary of some interesting experiments made by Dr. Paul Guttman (on the lower animals), which confirm many of the conclusions arrived at by Claude Bernard and others on the action of potash and soda salts. *The results are singular, and scarcely in accordance with the experience of medical men of the action of these substances on the human body.*"—(*Therapeutics*, p. 127, 5th Edition.) As showing how difficult it is for physiologists, with all their unfettered opportunities of experiment upon living animals, to interpret correctly the phenomena they produce, we may note in this connection that these investigators, though agreed that the potash salts in large doses arrest the action of the heart, are at variance as to the process by which this is effected.

Traube (says Dr. Ringer, *Ib.*, p. 127) asserts that the action on the heart is effected through the vagi nerves.

"This view Guttman (another vivisector) considers erroneous, as after the vagi nerves were both divided and the medulla removed, the potash salts still affected the heart as before, and even when the vagi were paralysed by woorali (curare) the potash salts still acted as usual on this organ."—(*Ringer*, p. 127.)

Ammonia, Acetate of (*P. B.*)—*Mindererus Spirit*, a well-known household remedy for colds. Stillé and Maisch say:—"Experiments upon animals show that this preparation in large doses affects them energetically; in rabbits, causing fatal tetanic spasms and dissolution of the gastric mucous

membrane. Given to healthy men, it does not appear to occasion any decided symptoms."—(*National Dispensatory*, p. 836.)

Ammonium, Chloride of (*P. B.*)—*Sal Ammoniac.* Dr. Smith (quoted by Stillé) applied two drachms of chloride of ammonium to the wounded thighs of dogs, and thereby caused their death in from 12 to 36 hours.—(*Wood's Therapeutics*, p. 526.)

Orfila introduced the same chemical into the stomach of a dog, causing it to die in violent convulsions and spasms.

Arnold found that 30 grains would kill a rabbit in 10 minutes.

Dr. Rabateau (*L'Union Medicale*, 1871, p. 330) injected the same drug into the veins of dogs with no apparent effect.

Sundelin and Böcker (*Beitrage zur Heilkunde*, Bd. ii., p. 170) and other experimenters say that chloride of ammonium impoverishes the blood.

Wood says (*Materia Medica*, p. 527) that "although I have given the drug very largely and freely," he has not found evidences of this action.

Amyl, Nitrite of (*P. B.*)—The use of this drug in medicine is declared by the Vivisecting School to be a brilliant example of the benefits conferred upon humanity by experiments on animals. It was discovered in 1844, by the French chemist Balard. In 1865, Dr. Richardson introduced it to the profession. Guthrie had previously observed its action in causing flushing; indeed, it would be impossible for anybody who had ever had a sniff of the drug to avoid observing this action. Some years later—that is to say, after all its clinical virtues had been well ascertained—Dr. Gamgee, by experimenting upon animals, demonstrated that Nitrite of Amyl lessened the blood pressure in the vessels; in other words, it dilates the capillaries, which is a pretty scientific way of saying it causes intense flushing. Every doctor who used the drug, on the recommendation of Dr. Richardson, must have known all

this. "Animal torture was unnecessary," concludes Dr. McCormick, Deputy-Inspector of Her Majesty's Hospitals and Fleet, after remarking that the use of Nitrite of Amyl for the relief of spasms of the heart "could have been very readily arrived at by letting a patient inhale its vapour." But so simple a process would not suit our physiologists, and, in sooth, would not make much of a paper to read before a learned society. So dogs, rabbits, and other animals were used, upon which to *demonstrate* phenomena which had already been observed by clinical methods. It is not true, therefore, that the discovery of the uses of Nitrite of Amyl was due to experiments upon animals though it is the fact that they were demonstrated by such means. But experimenters are not in perfect accord as to the interpretation of the phenomena which they observed in this way.

Wood says (p. 347): "An interesting question which here arises is, whether the dilatation is centric or peripheric. I believe it must be peripheral and not centric, in its origin, since both in my own experiments, and in those of Brunton, it occurred after the arterioles had been separated from the vaso-motor centres by division of the cord."

Mark the reply of the other vivisectors to all this. *Wood* says (p. 348), "The answer to these results is, *that opening the chest must derange most profoundly the pneumonic circulation* (just what we have always protested with all our might), and that all observations upon

"Bernheim, however, asserts that this cannot be so, and that the dilatation most be solely due to an action upon the vaso-motor centres, because he found that galvanisation of the cervical sympathetic still caused contractions in the vessels of the ear of a rabbit, to which nitrite of amyl had been given. As pointed out by Pick (*Centralblatt, Med. Wissen.* 55, 1873), Bernheim's experiment does not warrant his conclusion.

Dr. W. Filehne (*Pfluger's Archiv*, p. 478, Bd. ix.) dissents from the view here taken. . . . Filehne affirms that when to the animals whose lungs were exposed (that is to say, whose chests were cut open) inhala-

the comparative size of vessels are very apt to be mere guess-work when the change is slight."

In Schuller's experiments (*Berlin. Klin. Woch.* 25, 1874) after destruction of the cervical sympathetic in a rabbit, inhalation of the nitrite produced still further dilatation of vessels in the ear.

tions of the nitrite were given, the change of colour was not nearly so great as in the ears, and that if the sympathetic had been destroyed in the neck in a rabbit, and the nitrite of amyl exhibited, the vessels on the unwounded side actually became larger than those of the opposite ear."—*Wood*, p. 348.

In a rabbit experimented on by Dr. Hoffman, a hypodermic injection of this drug caused diabetes, but experimenters with the same drug on human beings have not detected this result.

Apomorphia.—This is an alkaloid prepared from morphia. It is used in medicine as an emetic and expectorant. Doctors using this drug for these purposes have found that in young subjects very considerable depression has been produced by it, with dangerous symptoms of paralysis of the heart. But Siebert and Moerz, experimenting with the drug upon animals, say that these facts are contradicted by their physiological observations, as they find that apomorphia does not affect the blood pressure, and that the pulse rises when the emetic effect is produced.—(*Bartholow's Materia Medica*, p. 459.)

Hypodermic injections of this poison in the lower animals elicit no evidence of pain, although in man they have been known to cause intense pain.—(*Wood*, p. 437.)

Quehl says the paralysis produced by the drug must be central, since neither the sensitive nor motor nerves nor muscles are affected by the poison.—(*Ueber die Physiol.*, Halle, 1872.)

Harnack, after experimenting upon frogs which he poisoned with apomorphia, after cutting off their legs, directly contradicts Quehl's conclusions.—(*Archiv. Exper. Pathol.* Bd., ii., p. 291.)

Moerz says that during the vomiting the temperature *rises*. (*Wood*, p. 438.)

Bourgeois declares that in man the drug has *no influence* on the temperature. — (*Wood*, p. 438.)

Ziolkowski says the temperature *falls* during the vomiting.— (*Ut supra.*)

Arsenic.—Drs. Ringer and Murrell (*Journal of Physiology*, I., p. 217) experimented upon frogs with arsenic.

Dr. W. Sklarck, of Berlin (*Reichert's Archiv*, 1866), experimented in a similar manner with this chemical on the muscular and nervous system of frogs, obtaining very different results from those of the English physiologists. These gentlemen endeavour to extricate physiological medicine from this difficulty by saying that the discrepancies in question depend upon the time of year at which the frogs were experimented upon. We do not dispute that this may materially affect the results, but of what avail is it to study the effects of the medical uses of a drug intended for the treatment of man upon a frog's system which behaves in one manner in spring and in a totally different manner in autumn? This confusion illustrates one other of the many fallacies of a system of medicine founded upon any such basis.

Atropine.—(*See* Belladonna.)

Beberine (*P. B.*)—An alkaloid, prepared from Bebeeru bark. It causes convulsions and paralysis in dogs and rabbits, yet in man no serious symptoms have as yet been recorded from its use.—(*Wood, Therapeutics*, p. 57.)

Belladonna (*P. B.*)— *Deadly Nightshade.*—The root and leaves of the poisonous plant *Atropa Belladonna* contain the alkaloid *Atropia;* it is entirely to this active principle that the physiological action of Belladonna is due. The plant and its alkaloid act much more mildly upon the lower animals than upon man. Its well-known action in dilating the pupil

of the human eye may instructively be compared with its powerlessness to cause any such effect on the pupils of the eyes of pigeons, or, as Stillé says, of those of other birds.

Birds and herbivorous animals eat Belladonna with impunity. "This is one of the many examples," say those great authorities, Drs. Stillé and Maisch, "which show the danger of concluding from the lower animals to man in regard to the uses of medicines, unless the mode of action in the two cases is first proved to be identical. In no animal is there any degree of that delirious excitement which Belladonna produces in man.—(*Therapeutics*, p. 276.)

Dr. Ringer (*Materia Medica*, p. 454, 5th Ed.) says :—"Certain animals, like pigeons and rabbits, appear to be almost insusceptible to the influence of Belladonna," and "Belladonna, it is asserted, has very little effect on horses and donkeys." So powerful is the action of atropine on the human organism, that it is usually medicinally administered in the very minute dose of from $\frac{1}{120}$ to $\frac{1}{40}$ of a grain. Yet Calmus found that no less than fifteen grains are required to kill a rabbit, and Ringer says that two grains administered hypodermically are necessary to kill a pigeon.—(*Materia Medica*, p. 454.)

Meuriot administered atropine to various animals, and then opened their abdomens whilst alive. He declared that the poison caused the intestines to undergo violent contraction.

Bezold and Bloebaum did exactly the same, and they affirm that they found the poison caused marked sedation (calming) in the same organs.

Meuriot and Harley contradict each other upon the results of their experiments on the action of atropia on the secretions of the alimentary canal.

Wood (*Therapeutics*, p. 252) says that none of the experiments seem decisive, and that their results are not in accord with clinical experience.

With respect to the antagonism of Belladonna in cases of opium poisoning, Dr. Erlenmeyer is opposed by Dr. Brown-Séquard and Dr. Harley, who dispute the antagonism, as they say it has not been observed in experiments made on man and the lower animals. To this Dr. Ringer replies : "It must be remembered, however, that these drugs do not similarly affect animals and man."—(*Materia Medica*, p. 469.) Dr. Harley severely criticises the reputed cases of this antagonism, and "his conclusions," says Dr. Ringer, "are in some respects directly opposed to those of Erlenmeyer."

Surely, to any candid and unprejudiced medical man, the lessons taught by this account of the action of Belladonna would alone be sufficient to make him reflect that the anti-vivisectionists may not be such fools after all !

Benzoic Acid (*P. B.*)—Cruel experiments with this drug have been performed by different physiologists, with the result, says Wood, p. 531, that their testimony is "singularly contradictory."

Bromides of Potassium, Ammonia, Sodium (*P. B.*), **&c.**—Bartholow, Purser, and Laborde, experimented with the bromides upon the nervous system of different animals, and arrived at certain conclusions, which were promptly contradicted by Darmourette and Polvette, after a similar series of experiments.—(*Wood, Therapeutics*, p. 325.)

Caffein (*P. B.*) is prepared from Coffee. Much diversity of opinion exists amongst physiologists as to the action of this drug. A great number of animals have undergone experiments with it, causing violent spasms, convulsions and excitement, ending in death. Dr. *Mary* P. Jacobi (note that this was a lady experimenter) actually experimented with this potent alkaloid *on a patient whose brain was exposed.* (See *Stillé's Therapeutics*, p. 312.) Those who experiment with it on frogs note a different action when they use different species of these animals, the action on *rana esculenta* being very different from

that on *rana temporaria*.—(*Lauder-Brunton*, *Materia Medica*, p. 72.)

Calabar Bean (*P. B.*)—The dried seed of *Physostigma venenosum*. Bartholow and Bourneville experimented with calabar bean, and arrived at conclusions opposite to each other. Indeed, the most conflicting testimony is given by different physiologists as to its action on men and animals. Wood (*Therapeutics*, p. 310) says:—"The researches of Köhler, of Vintschgau, and of Rossbach and Frohlich, are especially open to doubt, on account of their statement that Calabar bean tetanizes." In summing up the evidence of various vivisectors as to its action upon the vagi nerves, it appears that "no positive conclusion can be reached."

Dr. Harley (*Practitioner*, Vol. III., p. 163) declares that it *does not affect the arteries* when applied locally.

Dr. Fraser, who made 331 experiments with the drug, chiefly on rabbits, contradicts this, and says he has demonstrated that the local application of the drug *produces dilatation of the arteries* (Wood, p. 316).

Bartholow sums up the statements of the conflicting physiologists in these suggestive terms:—"The applications of physostigma to the treatment of disease are by no means so important as the elaborate study given to its physiological action by various observers would seem to indicate."

Calomel.—*See* Mercury.

Camphor (*P. B.*)—This drug acts differently on different animals. In the articulata it acts as a virulent poison; in birds it causes epileptiform seizures; in mammals it is an intoxicant, causing ultimately convulsions and death. In man, Stillé says (p. 334), "in no instance does camphor seem to have caused the death of a healthy person."

Camphor, Monobromated.

Bourneville says, after having performed a number of experiments upon animals with this drug, that it *lowers the temperature, lowers the pulse, and causes sleep.*

Trasbot, in his experiments, says it caused symptoms like those of strychnia.

Trasbot experimented with the same drug in a similar manner upon dogs, and found that it *neither lowered the temperature nor pulse, nor did it cause sleep.*

Valenti y Vico inferred from his experiments that it was an antidote to strychnia.—(*Stillé, Therapeutics,* 336, 2nd Ed.)

Carbonic Acid Gas.—The effects of the inhalation of carbonic acid by man do not correspond with those observed in animals. Dogs inhaling this gas in the proportion of 1 part in 9 are thrown into an anæsthetic sleep; but Stillé and Maisch say that in similar experiments on man no such anæsthetic influence is produced. In dogs which have succumbed to a fatal dose, the heart and lungs are found gorged with blood (*Demarquay*). "In the case of a young man who died in this manner in the Grotto of Pyrmont, the lungs were not engorged, and the heart contained very little blood."—(*Stillé and Maisch*, p. 38.)

Chloral Hydrate (*P. B.*)—Experimenters with chloral hydrate contradict each other about its physiological action in the most bewildering manner.

(*See* American *Journal of Insanity*, July, 1871, and American *Journal of Medical Science*, April, 1870.)

Chrysophanic Acid.—Experimenters with this drug do not agree respecting its action. Some declare that it is a purgative, while the greater number assure us that it has no such property. They are equally divided as to the question of its elimination from the system after its exhibition.—(*Stillé and Maisch*, p. 42.)

Citric Acid (*P. B.*) is prepared from lemon juice. Physiologists have experimented with it upon cats, rabbits, and other

animals, with results which should teach medical men how fallacious it is to expect the lower animals to illustrate the uses of medicines proposed to be exhibited on human beings. Citric acid proves to be a powerful poison to these animals; it causes in them the most violent tetanic spasms. In man, however, no spasmodic or any other alarming symptoms ever arise from its use. — (*Stillé and Maisch*, p. 44.)

Coca Leaves (*P. B.*)—Physiological experimenters are greatly at variance as to the influence of this plant upon men and animals.

Coculus Indicus is a well-known poison used for catching fish by intoxicating them; under its influence they whirl round, and lie motionless on the water. In dogs and other animals it causes muscular tremors, convulsions, and tetanic spasms. It is remarkable that there is no case on record where such effects have been produced on man by this drug. We have cases of stomach irritation, congestion of the brain and death, but no spasmodic phenomena.—(*Stillé, Therapeutics*, 2nd Ed., p. 436.)

Colocynth (*P. B.*) has very little action upon horses, sheep, and swine; but it is a powerful purgative to dogs and rabbits, on which it acts violently, causing inflammation of the bowels. Small doses act powerfully on human beings.

Conia.—*See* Hemlock.

Copper, Sulphate of (*P. B.*)—Atrociously cruel experiments upon dogs have been tried with this poison; given by the mouth it excites violent vomiting, but some physiologists, to prevent this, have tied the gullet, and thereby have caused convulsions and paralysis. Yet Levi and Barduzzi gave a horse daily 15 grains of sulphate of copper for 30 days without injury. An ass was subjected to the same treatment with similar results.

Corrosive Sublimate.—(*Perchloride of Mercury, P. B.*)—

Drs. Wright and Wilbouchewitch (*Archiv de Phys.*, Sept., 1874) experimented with corrosive sublimate upon rabbits, and found that it *very greatly diminished* the number of the red blood corpuscles.

Dr. Keyes (Amer. *Jour. Med. Sci.*, Jan., 1876) did the same, and he says that it *increases* the number of the red blood corpuscles.

Croton Chloral Hydrate.—(*Butyl—Chloral Hydrate, B. P.*)—

This drug was introduced by Liebrich, who claimed as the results of his experiments that it lessened sensibility before it produced its narcotic effect.

But the much more elaborate researches of J. V. Merino (*Archiv Experim. Pathl. Pharm.*, Feb., 1875) do not bear out these assertions.

Croton Oil (*P. B.*)—Armand Moreau experimented with the intestines of living dogs by cutting them open and putting croton oil into them, and obtained opposite results to those obtained by M. Thivy, who did the same.—(*Gaz. Med.*, 1871.)

Hertwig and Bucheim (*Virchow's Archiv*, xii., 1) injected croton oil into the veins of animals, and found that *purgation did not follow.*

Conwell did exactly the same, but with a *contrary result.* Stillé (*Therap.*, Vol. ii., p. 451) says that it will sometimes purge human beings even when applied externally.

Currier's Sumach.—(*Coriaria.*)—This plant is poisonous to man. "Snails that had lived on its leaves have poisoned those who ate them"—"but rabbits were usually unaffected."—(*Stillé and Maisch*, p. 466.)

Elaterium (*P. B.*)—This drug, even in very small doses, causes in man violent purging, with severe griping, and more or less vomiting; "but, however it may be given to dogs and rabbits—does not vomit or purge them, but destroys them with tetanoid phenomena."—(*Stillé and Maisch*, p. 521.)

Extract of Meat.—Kemmerich arrived at the singular conclusion that concentrated cold extract of horse-flesh injected into the stomach of dogs in large doses is fatal to them, with all the appearances of cardiac paralysis! The experiment does not appear to have yet been tried upon man, but we do not consider that extract of meat is a dangerous poison to the higher animal.

Fly Agaric, or Fly Fungus (*Fungus Muscarius*).—This poisonous fungus yields the deadly alkaloid *Muscarine*. In commenting upon a case of poisoning by this fungus, related by Dr. Chevers, Stillé says (p. 664), "in this narrative there is absolutely nothing to suggest, or to be explained by the results of the physiological experiments above described." They never do explain anything which is of any importance.

Ringer and Morshead found that muscarine *dilated* the pupil when applied locally.

Schmiedeberg and Harnack discovered that it *contracted* the pupil both when applied locally and given internally.—(Brunton *Materia Medica*, p. 187.)

Foxglove Leaves.—(*Digitalis, P. B.*)—This drug is perhaps the most valuable one which we possess for the treatment of certain forms of heart disease. It has often been claimed by our opponents of the experimental school that its virtues were discovered in consequence of the great number of investigations which have been carried out with it upon the lower animals. But this is a typical case of the confusion so often made between a discovery and its demonstration. "Long before" (we quote from Stillé's great work, p. 511) "its mode of action had been experimentally investigated, it was established as the most efficient remedy for dropsy depending upon disease of the heart, or upon that form of renal disease which consists of congestion and tubal obstruction." It is poisonous to plants watered with its infusion. Most animals, the carnivorous more readily than the herbivorous, are poisoned by this agent (*Stillé, loc. cit.*) Great confusion exists amongst

experimenters as to its action upon the heart. Its action upon the kidneys has been studied by numerous observers with diverse results. With reference to its influence on the blood pressure, note the following quotation :—

Boehm, experimenting with digitalis, found that under certain anatomical conditions it does not increase arterial pressure.—(*Wood*, p. 138.)

Ackerman, under precisely similar circumstances, found the direct opposite.—(*Wood*, p. 139.)

The rise in blood pressure is regarded by Schmiedeberg, Boehm, and others, as entirely due to increased action of the heart and not to contraction of the vessels.—(*Brunton*, p. 911.)

With this view I cannot agree, and I still hold to the opinion which I expressed many years ago, that the rise in pressure is due in great measure to contraction of the arterioles.—(*Brunton*, *loc. cit.*)

"According to Saunders, Jörg, Hutchinson, and others, digitalis in moderate doses in the first instance, quickens the pulse, though other observers deny this effect."—(*Ringer*, *Therapeutics*, p. 411.)

Friar's Balsam.—*(Compound Tincture of Benzoin, P. B.)*—The history of this preparation is curious and instructive—it was probably invented in a monastery, and was used for centuries, especially for cuts and skin affections. When we began to be hyper-scientific in medicine and surgery, an old-fashioned remedy like this was contemptuously regarded as an old woman's heal-all, and it was relegated to the limbo of forgotten therapeutics except among the poor and ignorant who did not care about fashion and science so long as they were cured. At last Mr. Bryant (*Lancet*, ii., 1876, p. 747) proved in his practice that its great reputation was well founded. "His results" (*Wood*, p. 532) "appear to challenge those obtained by the most complicated antiseptic surgery." Stillé says (p. 1436), "Those who considered the cure of disease of more consequence than the justification of a doctrine, adhered by its use, and the medicine survived the theory."

One of the regular arguments on behalf of vivisection is the claim that Professor Lister discovered the Carbolic Antiseptic system by experiments upon living animals. The plain truth is that perfect cleanliness on the surgeon's part, as Mr. Lawson Tait has proved, will achieve all Mr. Lister's results, especially when supplemented by an antiseptic balsam such as Mr. Bryant uses. But then, as we are not bidden to do "some great thing" with a cart load of apparatus and paraphernalia, we do not believe.

Gamboge.—This to man is a drastic purgative, often causing vomiting and griping; in large doses it acts as a powerful irritant, at times causing inflammation and death. (Garrod.) "Experiments upon animals with gamboge do not render its operation clear. It produces few symptoms of local irritation—and not uniformly either vomiting or purging."—(*Stillé*, p. 670.)

Gelsemium.—*See* Yellow Jasmine.

Glycerine.—Even in so apparently innocent a drug as glycerine this diverse action between men and animals has been observed. When large doses are injected subcutaneously in dogs, death is produced with effects resembling those of alcoholic poisoning, in a period varying—according to the dose—from one hour to several days. (*Dujardin-Beaumetz, and Audijé, Bull Therap.*, xci., p. 62.) In man, says Wood (*Therapeutics*, p. 584), no symptoms of poisoning have ever been produced by glycerine.

Fuchsinger says (*Pfluger's Archiv*, xii., p. 501; *Centralb. Med. Wiss.*, 1877) that in rabbits slightly poisoned with glycerine no sugar appears in the urine after the "diabetic puncture."

The experiments of Eckhard gave, however, a contrary result. —(*Centralb. Med. Wissen*, 1876, p. 273.)

"Its richness in carbon suggested its use as medicinal food, and especially as a substitute for cod-liver oil; but, as in so

many other instances, a little clinical experience showed the so-called scientific induction to be untrue. On theoretical grounds, also, it has been used in the treatment of *diabetes*, but without striking advantage."—(*Stillé, National Dispensatory, loc. cit.*)

Ground Ivy.—(*Glechoma.*)—This plant is a popular remedy in some places in the treatment of chronic bronchitis, and common colds. (*Ann Pratt's Flowering Plants*, Vol. IV., pp. 197-8.) Harmless to man, it is poisonous to horses and sheep.—(*Stillé*, p. 682.)

Guarana.—Mantegazza, the inventor of a horrible machine for the torture of dogs, which he called the "Tormentatore," capable of inflicting graduated pain, termed by him according to its degree "intense," "cruel," and "most atrocious agony," experimented with guarana, and found that it excited frogs and threw them into convulsions, that it influenced some warm-blooded animals in a similar manner, but made rabbits dull and languid, and produced a sort of intoxication in dogs. "It is curious," says Stillé, "to contrast these definite and striking results with those of Dr. Macdowall, of West Riding Insane Asylum. He experimented upon himself and two male attendants, and it soon become evident to him that even in very large doses its effect upon the body in a state of health is almost, if not quite, inappreciable." Its action in fact is very similar to that of tea and coffee.

Hamamelis.—(*Witch Hazel.*)—This is a most serviceable remedy for piles, and for arresting bleeding, yet Drs. Wood and Marshall experimenting with it were unable to obtain any physiological effect.—(*Ringer*, 12 Ed., p. 308.)

Hemlock Leaves and Fruit.—(*Conium, P. B.*)—Experimenters are much at variance as to the physiological action of Conium. Some say that it slows the heart's action, others deny this. Some declare that it increases the temperature of the body, others that it lowers it. One affirms that it renders

the blood dark and fluid, another protests that it has no such effect. Summing up all these conflicting results, Dr. Stillé says, "These antagonistic results of experiments conducted under determinate conditions illustrate the difficulty of drawing definite conclusions from such data and *the wisdom of preferring clinical bases for clinical rules.*"—(*National Dispensatory*, p. 456.)

Physiological experiments with this as with so many other drugs already mentioned do not in the least help us to understand its action when administered to human beings as a medicine. From hemlock we obtain the alkaloid Conia. Guttman says, this is one of the most active and powerful poisons to human beings, being "scarcely second to prussic acid." "Yet," says Ringer, p. 437, "some vegetable feeders, as the goat, sheep, and horse, are said to eat hemlock with impunity." Can anything be more absurdly unscientific than to test on these animals the action of a drug like hemlock for the discovery of its medical uses to man?

As the natural consequences of such confused pharmacology "concerning the action of this poison on the heart, very conflicting statements have been made."—(*Ringer*, p. 442.)

Dr. Verigo (*Schmidt's Jahrb.*, *Bd.* cxlix, p. 16) asserts that Conia acts very forcibly on the spinal cord as a *depressant*.

Verigo, Van Praag, and others affirm that lethal doses of conium cause a decided *lowering* of temperature.

MM. Polvette and Darmourette (*Archives Gén.*, 6e sév., t, vi., p. 89) say that it acts as an *excitant*.

Lautenbach asserts that the drug decidedly *increases* the temperature under similar conditions.—(*Wood*, p. 369.)

What a bitter satire is all this upon physiological medicine!

Henbane Leaves.—(*Hyoscyamus, P. B.*)—"All parts of this plant are highly narcotic, and it is used in medicine as a substitute for opium." It is poisonous to fowls, hence its name, henbane; yet on sheep, cows, and pigs, it has little or no effect. Hogs also can eat it with impunity. When our readers want to

confound a very positive and rash young physiologist, he may be baited thus: ask him innocently, "Why is this plant called henbane?" He will say, "Because it is poisonous to fowls." You must then ask him, "Why is it called *hyoscyamus* in Latin?" If he is weak in his etymologies, as he probably will be, he will say he does not know. This will give you the opportunity of telling him that though the plant is poisonous to fowls, the etymology of *hyoscyamus* shows that the plant may be eaten without harm by hogs. This will probably be new to him, and then you can proceed to ask him how it is if so many poisons act differently on different animals, to the extent that what is meat to one is bane to another, that we can learn from experiments upon them how to physic ourselves? His behaviour will probably be instructive. Fish are poisoned by it, though it has not much effect upon rabbits.

Hydrogen, Peroxide of.—Many experiments have been made upon rabbits and dogs by injecting this gas under their skin; it caused severe obstruction to the breathing, then convulsions, and death. But Guttman injected a solution of the gas into one side of a rabbit's abdomen, and a solution of sulphate of iron into the other, and found that the animal did not die. The experimenters thought they had discovered something useful to humanity by these experiments. "But," says Stillé, "though upon theoretical grounds this compound was introduced as a cure for *diabetes*, it signally failed after a sufficient trial by competent judges."—(*National Dispensatory*, p. 746.)

Ipecacuanha (*P. B.*)—This is a favourite domestic remedy, and much used as an expectorant and emetic. Notwithstanding its enormous use, and the great number of experiments upon animals made with it by Orfila, Majendie, and later by Dr. Dyce Duckworth and others, "its physiological action is not as yet well made out."—(*Wood*, p. 431). The experiments of investigators indicate that the active principle of ipecacuanha (*emetia*) has very little action upon the lungs, but

we know from daily observation that it is one of our most valuable and trustworthy expectorants.

D'Ornellas and Pecholier are in opposition as to the action of emetia upon sensibility, the one affirming that it is not, the other that is, affected. They are not agreed as to its action on the temperature.—(*Wood*, p. 432.)

It may be remarked that ipecacuanha does not cause vomiting in rabbits. Dr. Lauder-Brunton explains this by saying that the rabbit's stomach is so placed that it cannot vomit, but this is part of our contention, that animals being so differently constituted to ourselves, experiments upon them are untrustworthy guides in medical practice.

Jaborandi.—

Vulpian says that jaborandi does not slow the heart if curare be largely given so as to paralyse the vagus nerve.

Mr. Langley (*Journal of Anatomy*, x., p. 188), shewed the incorrectness of this by a series of similar experiments.

Ever the same story!

Lead.—(*Plumbum*, *P. B.*)—"The muscular action of lead in poisonous doses is exceedingly pronounced in rabbits, but is feeble in dogs and cats."—(*Wood*, p. 38).

Lead poisoning in man often produces loss of sensation and obscurity of vision, but Stillé says (p. 1,116), "Experiments upon animals throw no light upon the occurrence of anæsthesia, amaurosis, &c., from lead."

Matico Leaves (*P. B.*)—A valuable arrester of hœmorrhage. We do not refer to this drug because the physiologists have told us anything about it. It is so useful that they generally ignore it. Its discovery is interesting, and typical of the way in which we have gained the knowledge of most of our useful drugs. Its virtues were discovered by a Spanish soldier named Matio, from which Matico is derived. He was desperately wounded in Peru, and dragged himself under the shadow of the plants near him; in his agony, he plucked

some of their leaves and applied them accidentally to his wounds. To his great delight he found that they arrested the bleeding, and his wounds soon healed. In consequence of this, the plant is called, in Spanish, "Yerba soldado" and "Palo del soldado"—"Soldier's herb" and "Soldier's tree." This poor soldier did more than the physiologists have yet done for practical medicine.

Mercurial Salts.—(*As Calomel, Bichloride of Mercury, &c., P. B.*)—"The experience of generations strongly supports," says Dr. Ringer (*Materia Medica*, 12th Ed., p. 243), "the general conviction that in some diseases calomel, as well as other preparations of mercury, does increase the bile." But experience and clinical observation count for little with the experimental physiologists. Drs. Hughes-Bennett and Rutherford performed a very large number of cruel and excessively painful experiments on the livers of dogs. The abdomen was cut open, and a glass tube tied into the bile duct, with barbarous attendant circumstances, which placed the animals in an abnormal condition; mercurials and other drugs were inserted in the cut intestines to show their effects. The operators came to the conclusion that the doctors had been all wrong in their conclusions about calomel, and they proved to their own satisfaction that it did not increase the secretion of the bile. Of course no physician worthy of the name paid the slightest attention to these conclusions, but went on administering what his experience had proved to be so valuable; and fortunately so, for it ultimately dawned upon the intellects of Messrs Bennett and Rutherford that there was all the difference between administering calomel by the stomach, thereby mixing it with the gastric juice, and cutting open the upper part of the intestines and inserting the drug there. Rutherford also found that the curare given to keep the animals quiet, diminished the bile and made the heart's action weak and irregular—so that, as Mr. Reid said in the

House of Commons, April 4th, 1883 :—"The result of these experiments was simply nothing at all."

Milk.—The physiologists thought it might be useful in some diseases to inject milk into a patient's veins. "Donné demonstrated on animals the harmlessness of this proceeding." —(*Bartholow's Materia Med.*, p. 16.) Yet a hospital surgeon, writing in the *British Medical Journal* for June 6, 1885, says that, having tried the experiment on human beings, "the operation appears to have proved fatal in a few instances." In another of his cases in which, though there was temporary improvement, the patient died, he adds "it cannot be doubted that the result was hastened by the operation."

Mountain Laurel.—(*Kalmia latifolia.*) — The leaves and berries of this American plant are poisonous to man, but partridges feed on its berries, and their flesh kills men who eat it, as it acts upon them as a sedative poison. This was at one time doubted, and the physiologists thought that its poisonous action upon man must be due to putrefaction of the game. It was hard to have to admit that birds could eat berries which were poisonous to human beings, so Dr. Stabler tried a strong decoction of the plant upon himself, and found the fact was precisely as stated. An allied plant, *Andromeda Mariana*, is called "stagger bush," and is fatal to lambs and calves.—(*Stillé*, p. 798.)

Musk (*P.B.*)—Jörg and Sundelin have experimented with Musk upon healthy persons with contradictory results—the physiologists say its action on the organism is very feeble, yet there is considerable clinical evidence of its use in nervous diseases.—(*Wood*, p. 197.)

Nitrite of Amyl.—*See* Amyl, Nitrite of.

Nitrate of Silver.—(*Lunar Caustic, P. B.*)—This powerful chemical has been largely used in experiments upon animals. It has been very cruelly injected into their veins, causing choking and violent spasms, finally retching, vomiting, and

death. Dr. Stillé says, however, that there is not the slightest analogy between these effects and those produced on man by its long-continued use.—(*National Dispensatory*, p. 235.)

Nitropentane is a compound allied to the Nitrite of Amyl. It is said by Schadow to produce no peculiar symptoms when respired by man, yet inhalation of its vapour by dogs and cats caused dilatation of the pupils and epileptic convulsions.—(*National Dispensatory*, p. 169.)

Opium (*P. B.*)—Let us imagine that a quantity of a new drug, called opium, is being examined for the first time by a special committee appointed for the purpose by the College of Physicians; let us assume that the drug has been brought from a far country, and that nobody knows anything about its properties, except some vague traveller's tales about its medicinal effects. The physiologists proceed to investigate its action by a long series of experiments upon animals; they give it to frogs, and they find that small doses throw them into tetanic spasms. Next they try it on a pigeon; they give him twenty grains, and he is none the worse for it. Emboldened by their success, they give thirty grains to a rabbit, and no effect is produced. They are beginning to believe that the traveller's tales are stupid exaggerations, especially as they discover that ducks and chickens, like the pigeons and rabbits, are never the worse for its administration. They resolve now to try it on a hospital patient, and proceeding with extreme caution, as they think, they decide not to venture at first beyond the dose they gave to the pigeon, namely, twenty grains. The patient is a powerful navvy, yet to their consternation and distress he is promptly killed by the dose! If physiological medicine were of any value, surely the method followed by these investigators was right and cautious. Yet how fatal their method when reduced to practice! When opium is administered to human beings in large doses it contracts the pupils to a pin point; in birds the pupils are not affected; in horses they are

widely dilated; in dogs under its influence the pupils first dilate and then contract. Opium seems as if it were created to confound the physiologists! Dr. Mitchell says it is impossible to kill a pigeon by opium given by the mouth; but Flourens affirms that a single grain will throw a sparrow into profound stupor. None of the opium preparations cause sleep in pigeons, ducks, or chickens. With dogs, cats, and rabbits large doses of opium produce sleep, usually with convulsions. In frogs opium only causes tetanus. Race greatly modifies its effects on man. It drives Javanese and Malays into temporary madness.—(*Ringer*, *Materia Medica*, 5th Ed., p. 478.)

Opium contains a number of alkaloids and neutral bodies, the physiological properties of which have been investigated. The most important are the following:—*Morphia*, *Thebaia*, *Narcotina*, *Codeia*, *Meconia*, *Narceia*, *Cryptopia*, and *Papaverine*. All these preparations act differently upon man and animals. The statements made concerning their action by experimenters are very conflicting.

"As regards man," says Dr. Ringer (p. 494), "*morphia* is the most powerful alkaloid; but, according to Bernard, as regards animals, it ranks fourth. Thebaia is to animals the most poisonous alkaloid; but its effect on man is much less marked; again, it is said that, with respect to animals, narceine is the most soporific of the alkaloids, but its action on man is far less than that of morphia."

Morphia is a powerful poison to man, a quarter of a grain being an ordinary dose as a medicinal agent. Yet "birds," says Stillé, "tolerate the action of morphia to an almost incredible degree." A pigeon has been known to survive a dose of 12 grains. Thebaia is an uncertain drug apparently. Falck injected hypodermically a grain and a half of it into a a dog, and killed it in ten minutes; yet Fronmüller affirms that he has given as much as six grains to a man without result. Liededorff and others say the same, but Eulenberg got rather alarming results with only $\frac{1}{100}$th of a grain. In

face of these contradictions the experimenter Wood has the hardihood to say, "it *must* act upon man as upon the lower animals."

Narcotina is very fatal to pigeons, but rabbits, guinea-pigs, and dogs are little affected by it.—(*Wood*, p. 232.)

Codeia makes dogs and rabbits move in a circle or backwards, and later it produces convulsions and death. Robiquet, having made these observations, proceeded to administer it to children, "in whom it caused very alarming symptoms." Either he must have taken for granted that the poison would act differently upon animals and man, or he concluded that its action in both cases would be similar; in any case, the poor children had a narrow escape from "dying scientifically."

Orfila injected *Meconia* into horses and dogs without effect, yet Harley, experimenting upon man in the same way, found it "a very excellent hypnotic."—(*Wood*, p. 235.)

It is proper to say that Fronmüller did exactly the same "with entirely negative results."—(*Wood*, p. 235.) Experimenters differ in a similar way as to the action of another opium preparation known as Meconic acid.

Narceia.—Many physiologists have experimented with this drug upon various animals, and arrived at conclusions which were promptly contradicted by another set of equally competent and painstaking observers. It is said that it causes in frogs sleep, convulsions, and death, but has little or no effect upon pigeons, rabbits, dogs, or guinea-pigs, though it causes fatal convulsions in mice. Many experimenters found it act very feebly upon man in Pennsylvania Hospital. (*See Reports, of the Hospital*, 1868.) This was fortunate for the patients, and proves (if it proves anything) that man is not constituted like frogs or mice, but is more akin to pigeons and rabbits. Claude Bernard, however, experimenting upon the same animals obtained quite opposite results, so that it is evidently not a satisfactory drug, even for hospital patients!

Cryptopia, according to Harley, causes wild delirium in dogs, yet when he injected it beneath the skin in man (bold practitioner !) it only caused "very slight symptoms."

Papaverine. — Claude Bernard and Baxt, experimenting upon animals with this drug, arrived at what Wood terms "irreconcilable conclusions" (p. 223.) Administered to frogs it was found to act as a convulsant, but rabbits and guinea-pigs bore enormous doses of it. One physiologist gave it to dogs without any effect, but another found that it produced profound coma, and Hoffmann believes it to be inert in man, because he took seven grains himself without any physiological results.

Porphyroxia is another of the many opium salts. It convulses frogs, pigeons, sparrows, and guinea-pigs ; yet, according to Schroff, large doses are without influence upon man.

Whether therefore we consider opium in its crude state or separate it into its active principles, its physiological effects are utterly at variance with any consistent theory applicable to the science of medicine.

Phosphoric Acid.—(*P. B.*)—Notwithstanding the labours of many physiological experimenters it is quite impossible to discover what are the real properties of this medicine, so contradictory are the views expressed as to its action. Dr. Stillé says (p. 71), "The views expressed by different writers are not easily harmonised."

Podophyllin.—(*P. B.*)—This well-known drug has been the subject of many investigations as to its action upon the liver. Dr. Anstie studied its action on dogs and cats. Writing of these experiments Dr. Ringer says (p. 385), "The animals suffered great pain, and soon became exhausted." They vomited violently, their intestines were congested, inflamed, and ulcerated by the injection of an alcoholic solution of the drug into the abdomen, and as the result of these atrociously cruel experiments, Dr. Anstie came to the conclusion that

podophyllin was not a cholagogue, that is to say, it did not increase the secretion of bile. Rohrig performed more experiments, the results of which were opposed to the statements of Anstie, and then Professor Rutherford began his long series of awful vivisections upon dogs for the Edinburgh Committee, endeavouring to reconcile the conflicting results of other experimenters. "These experiments," says Dr. Stillé (p. 1124), "have led to diametrically opposite results.

Poison Oak.—(*Rhus Toxicodendron.*)—"The medicinal virtues of this plant are too uncertain to inspire any confidence."—(*Stillé*, p. 1464.) Dogs have died after being merely exposed to the emanations of this plant, and they are poisoned by its juice, yet herbivorous animals devour its leaves with impunity, and it is recorded that two children who between them had eaten a pint of the berries were not killed by them, though they became delirious and convulsed.

Prussic Acid.—(*Hydrocyanic Acid, P. B.*)—This, as everybody knows, is one of the most deadly poisons to human beings, yet on horses and hyænas it has little or no effect. The elephant, however, is destroyed by a relatively small dose.

Claude Bernard and others said that after poisoning by prussic acid the venous blood of the animals experimented upon was of a *bright arterial hue* at the *post mortem*. — (*Wood*, p. 182.)

Bischoff and other German investigators say that they found nothing but *dark venous blood* either in man or animals so poisoned.—(*Wood*, p. 182.)

Boëhm and Knil (*Archiv für Exper. Pathol. und Therap. Bd.* ii., p. 137) experimented on cats with this poison and obtained certain results.

Preyer performed the same kind of experiments on rabbits and obtained quite different results.

Rossbach and others found that it lowered the frequency of the pulse.

Wahl found that it increased it.

when inj

Boëhm and Preyer contradict each other as to the action of this drug on the respiration.

Kolliher and Stannius are at variance as to its local effects on the nerves.—(*Wood*, p. 187.)

Some of these experiments were of the most terrible kind, such as opening the chests of rabbits and exposing the heart, and then administering the poison.

Quinine.—(*P. B.*)—Physiologists are not agreed as to the therapeutic action of quinine.

Professor Binz poisoned a cat with quinine and afterwards examined its blood. He found the white corpnscles much less abundant than those in the blood of an unpoisoned cat.—(*Virchow's Archiv, Bd.* xlvi., p. 137.)

Schwalbe and Geltowsky performed similar experiments and could detect no difference in the blood before and after poisoning by quinine.—(*Pfluger's Archiv. Bd.* i., p. 203.)

Binz experimented with quinine on ten dogs and rabbits, and found that it killed the microscopic entities which cause septic diseases.

Professor Wood says these experiments indicate very clearly that it does nothing of the sort.—(*Wood*, p. 73.)

It has been maintained by many physicians, and apparently confirmed by experiments on animals, that quinine is "dangerous and even criminal in any diseases of pregnant women."—Dr. Jos. J. West (*Savannah Journal of Medicine*, Vol. i., p. 19.)

To test this question, Professor Chiara, of Milan, experimented "*in his public service*" with quinine "on eight women, all in the eighth month of pregnancy."—(*L'Union Médicale*, Nov. 20, 1873.) Happily no untoward results followed.

Rye, Ergot of (*Ergot, P. B.*)—

The physiological observations of Holmes and of Wernick on the action of ergot [illegible] by t[illegible] on the circulation are directly contradicted by Dr. Paul [illegible] the abdom[illegible]*liner Klin Wochenscht.*, 1869, No. xii [illegible]ously [illegible]l experiments, D [illegible] conclusion that

performed similar experiments on vivisected rabbits by extirpating the cervical ganglia. The results obtained by Eberty are in accord with those of Vogt, and disagree with those of Dr. Holmes.—(*Wood*, p. 546.)

Sanguinaria.—(*Bloodroot.*)—This plant is a native of North America, and is used in bronchitis, asthma, and dyspepsia.

Its "physiological action," as shown by many experiments upon animals, "bears no relation to its medicinal use."—(*Stillé*, p. 1254.)

Sarsaparilla.—(*P. B.*)—Doctors are not agreed as to the question of the efficacy of this drug, and though some surgeons still hold by it, the physiologists are sceptical as to its uses.

Palotta experimented with it, and found its alkaloid produce gastric disturbance, vomiting, and slowing of the pulse.

Bœcker found it to be devoid of physiological activity and therapeutic power. — (*Bartholow's Materia Medica*, p. 255.)

Senega.—(*P. B.*)—This is a most valuable medicine for relieving the bronchial troubles of aged people. The experimenters discourse learnedly about its action on the various organs of the frog, but their investigations have thrown no light on its clinical application, and they give us no hint as to the mode in which the bronchial and pulmonary disorders are relieved by its use.—(See *Stillé*, p. 1287.)

Soda.—(*P.B.*)—The Salts of Sodium seem to have little influence over the higher animals, but frogs are more susceptible to their action, dying in convulsions after the injection of the drug.—(*Virchow's Archiv*, *Bd.* xxxiii., p. 507.) As usual, there are contradictions between eminent physiologists as to the action of this medicine upon animals.

Grandeau (*Robin's Journal de l'Anatomie*, 1864) found that the [illegible]ation of one hundred and

According to Guttman (*Virchow's Archiv.*, *Bd.* xxxv.), the Soda salts, when injected into

seven grains of the carbonate of sodium into the vein of a dog produced only very slight symptoms, and that thirty-five grains of the nitrate administered in the same way to a rabbit only caused some convulsive movements.—(*Wood*, p. 593.)

Guttman says that these salts are without influence upon the nerve centres, the peripheral nerves, or the muscles.—(*Wood*, p. 594.)

the blood in very large amounts, will slowly cause death, the agony being very prolonged, and, when the chloride is used, convulsions are developed.—(*Wood*, p. 594.)

Podocaepow says that they do exert a very feeble action upon the peripheral nerves and the muscles.—(*Wood*, p. 594.)

The effects of the administration for several days of large amounts of salt (chloride of sodium) upon human beings have been elaborately investigated by Dr. Münch, and found to be very feeble.—(*Wood*, p. 594.)

Sow-Bread.—(*Cyclamen*).—This plant is used in domestic medicine in France. Pigs can eat any quantity of its root without harm; yet fish are poisoned by its juice, and will die in water containing $\frac{1}{3000}$th part of the juice of this root. Vulpian says it is fatal to frogs. Claude Bernard made many experiments on animals with the plant, and they led him to conclude that its active principle, *cyclamin*, resembled curare in its action; but, as he injected a large amount of the liquid in which it was dissolved into their windpipes, it is very likely they died of "asphyxia, and not of *cyclamin*."—(*Stillé*, p. 492.)

Spanish Fly.—(*Cantharides*, *P. B.*)—According to the experiments of Orfila and of Beaupoil on the physiological action of Cantharides upon dogs, it would appear that this medicine acts differently upon men and animals.—(*Wood's Therapeutics*, p. 563.)

Squill (*P. B.*)—Everybody knows how valuable this drug is in bronchial affections; it is, perhaps, the commonest

ingredient in a bottle of ordinary cough medicine. Yet, as Dr. Stillé says (p. 1279), in summing up the results of many experiments upon animals with the active principle of squill—*scillitin*—"There is nothing in the results of scientific investigation even to suggest that squill acts upon the bronchial mucous membrane, but the much more direct and conclusive evidence of clinical experience leaves no doubt of its great value in bronchitis." Some physiologists, quoted by the author of these remarks, killed a number of rabbits by a poisonous dose of the drug; it produced violent inflammation and erosion of the stomach, and hæmorrhage about the heart, kidneys, brain and lungs was found; but on the same experiments being repeated by Husemann and Konig no injuries of stomach or kidneys were discovered.

Stramonium.—(*Datura Stramonium—Thorn Apple, P. B.*)—Stramonium is almost as deadly a poison to man as belladonna; yet insects of the caterpillar tribe feed upon it, and goats devour it without injury. A decoction of the leaves, on the other hand, when merely applied to the skin of the rat, caused convulsive movements, and large doses have caused death in horses.

Strychnine (*P. B.*)—An alkaloid prepared from Nux Vomica. This deadly poison, like so many others which we have considered, bears out to the full our contention that it is in vain to attempt to discover the physiological action of drugs on man by experimenting with them upon animals. "Very minute portions of strychnia in the soil will destroy the life of growing plants."—(*Stillé Therapeutics*, p. 1362.)

Flies and intestinal worms are readily killed by it, and it is very fatal to fish. It is generally believed that the frog is peculiarly sensitive to strychnine, but Falck maintains that in proportion to its weight it is really not so susceptible to its influence as various mammals, and that "it requires four times the dose needed by dogs, cats, rabbits, &c., to produce an equal effect upon frogs."—(*Stillé, loc. cit.*) Birds appear to

be comparatively insusceptible to its action. Stillé says that a hen, in progressive doses, at last took two-and-a-half drachms of nux vomica daily. It requires ten times as much strychnine to kill a chicken as would suffice for a pheasant. Yet half a drachm of this poison has proved fatal to human beings.—(*Guy and Ferrier's Forensic Medicine*, 4th Ed., p. 572.) The ruminating animals are not so readily affected as other quadrupeds when the poison is taken by the mouth. Ten grains may fail to kill a sheep when thus administered, though half of a grain may kill a man. The same would be fatal to the sheep if administered hypodermically or into the veins. The action of the poison on the goat is similar to that on the sheep.

In whatever way it is given to cats, whether by the stomach, injected into the veins, or under the skin, they "resist it singularly," says Stillé. Yet dogs are easily killed by it. It has been enclosed in fulminating bullets to kill whales, and it has been observed that when so poisoned they perish in the spasms which are so characteristic of its action on many other animals, yet "guinea-pigs and monkeys are said to be comparatively insusceptible to it."—(*Stillé, loc. cit.*)

As we have said, half a grain has proved fatal to an adult, and it is on record that a child died in four hours from taking one-sixteenth of a grain. Dr. Lauder-Brunton minutely details the atrociously cruel experiments of Majendie on the physiological action of strychnine upon dogs. He terms the *modus operandi* "a model of this method of research." As the great English experimenter so highly praises the system followed by the most cruel perhaps of all the foreign physiologists, it is only fair to assume that it is imitated in our English laboratories. Dr. Lauder-Brunton in page 147 of his *Text Book of Pharmacology* has lifted the veil for us.

The strychnine was introduced under the skin of the thigh of a dog; soon the poison began to produce symptoms of general malaise; the poor beast "took shelter in a corner of

the laboratory," and convulsions of the muscles of the body occurred, "the fore feet quitting the ground for a moment on account of the sudden extension of the spine." The animal was quiet for a few seconds, and was then seized with convulsions "more marked and prolonged than the first." Others succeeded, gradually becoming more severe. Each time the animal was touched a convulsion immediately followed. My readers will now be in a position to understand what is the value of Mr. Erichsen's statement when he says, "the experiments consisted chiefly of hypodermic injections, and were mostly of a painless character."—(*Report for* 1887.) No cutting operation could have caused more intense suffering than this injection of strychnine caused the dogs used by Majendie. As for the utility of such experiments Stillé says, *loc. cit.*, "Although physiological experiments do not lead to the suggestion that strychnine acts upon the peripheral ends of nerves, clinical observation, as in so many other cases, is supposed to demonstrate what the former method has failed to show." This is a very important admission emanating from a great authority on Materia Medica, and tends to prove that we are not retarding the progress of medical science by our efforts to confine it to its proper sphere.

Tartar Emetic.—(*P. B.*)—*Tartarated Antimony.*—Many cruel experiments have been performed upon animals with this drug. It seems to have been proved in this instance that its action is precisely the same on the lower animals as on man.—(*See Wood's Therapeutics*, p. 151.) In contradiction to this statement, Dr. Lauder-Brunton says that "Ipecacuanha, or Tartar Emetic, will cause vomiting in man, but does not do so in rabbits. The reason of this is that the position of the stomach in the rabbit is different from that in man, and is such that the animal cannot vomit."—(*Pharmacology*, p. 40.) Nöbiling had a theory that the action of Tartar Emetic upon the heart is owing to the potash it contains. Of course he

performed a number of experiments to support his theory, and equally, of course, another experimenter (*Wood*, p. 151), says, "This theory in itself is so improbable that it would seem scarcely worthy of discussion were it not for the fact that Nöbiling asserts that the tartarate of antimony and soda is not poisonous" (even to such lengths will men go who have a theory to support!) "Dr. Radziejewski (*Reichert's Archiv für Anatomie*, 1871), has repeated and extended the experiments of Nöbiling, and completely disproved both the asserted fact and the theory based upon it."—(*Wood*, p. 151.)

"A rabbit," says Wood, "poisoned with this drug could still drag itself around, and suffered its paws to be deeply burned without evincing the slightest evidence of feeling." Upon this our author says, "In man the anæsthesia which occurs in animals has been overlooked, but in the advanced stages of poisoning it is no doubt present." This point evidently wants clearing up!

Thein, from *Tea*.

Chemists and physiologists tell us that the active principle of tea, *Thein*, and that of coffee, *Caffein*, are identical. Dr. A. Burnett experimented with these alkaloids upon frogs, mice, rabbits, and cats, and came to the conclusion that they were "identical throughout the whole range of their action." Are we to conclude therefore, that the action of tea and coffee on the human system is identical? By no means. Says Stillé (p. 1424), "The identity of these alkaloids in their physiology does not imply a similar identity in tea and coffee. As little should we be entitled to infer that all alcoholic drinks produce identical effects because they all contain alcohol as their chief constituent. It is just as certain that tea and coffee differ in their action upon the human system as that Rhenish or Bordeaux wines act very differently from whiskey or brandy, although in all of these liquors the common cause of their effects is alcohol." So much, therefore, for the value of physiological medicine!

Toot Plant of Australia.—(*Coriaria Sarmentosa.*)—This is exceedingly poisonous to human beings, yet native horses and cattle, and it is said even "old colonists" eat the plant with tolerable impunity.

Fifteen berries of another species (*Coriaria Myrtifolia*) have caused the death of an adult, a teaspoonful of an extract of the juice will kill a cat in two hours, yet when the plant is given to rabbits they do not appear to be affected by it.—(*Woodman & Tidy's Toxicology*, p. 392.)

Tobacco.—The active principle of this plant is nicotia, and it stands next to prussic acid in the rapidity and energy of its poisonous action. Tobacco is poisonous to all forms of life, yet "herbivorous animals are not readily affected by it."—(*Stillé*, p. 1406.)

Many experimenters have investigated its action on the nerves, muscular system, and circulation of the lesser animals, chief of whom are Traube and Rosenthal, but Wood says, p. 363, "that the results obtained by Rosenthal are difficult to reconcile with the effects—already quoted from Traube."

Trimethylamina.—This drug was first employed medicinally for the cure of articular rheumatism in 1854. It is obtained by distilling herring brine or stale fish with lime. Injected under a rabbit's skin it caused trembling, convulsive movements, agitation, increased sensibility and quickening of the breathing and heart's action—then depression or collapse, paralysis, and death by asphyxia, in fact, such symptoms as were termed by Mr. Erichsen in his report as consequent upon "hypodermic injections" and "mostly of a painless character." To dogs they gave the drug by the mouth, producing vomiting, anxiety, distress, immobility, muscular tremors, emaciation, bloody urine at the end of six days. (Note the length of time occupied by these injection experiments, and the pain and extreme misery inflicted on the animals).

When the rabbits were killed by the injections, mortification was found at the point of the insertion of the needle, the lungs

and kidneys were congested, yet all these things we are told are painless and trifling because they do not involve vivisection in the ordinary sense.

Husemann, Dujardin-Beaumetz, and Stillé, are at variance as to the physiological action of the drug. Its action upon man appears to be quite different from the effects observed on the rabbits, and it has been entirely superseded as a remedy for rheumatism by the Salicylates, so that the sufferings of the animals have not in this instance conferred any boon on medicine.

Urea.—Ségalas demonstrated that urea injected into the veins of animals notably increased the discharge of urine. According to Rabateau it exhibits no diuretic action in human beings even in very large doses.

Veratria.—(*Veratrine, P. B.*)—Obtained from cevadilla seeds. This is an exceedingly powerful and dangerous alkaloid. Even the minutest quantity brought in contact with the nostrils occasions great and continued irritation, sneezing, and coughing. Injected hypodermically, it causes the most intense pain, as though one were burned with hot needles. Even the fortieth or from that to a twentieth of a grain inserted under the skin causes a tingling which begins in the fingers and toes and extends over the whole body. Yet we know that Kolliker (*Virchow's Archiv, Bd.* x., p. 261) opened the skulls of living frogs and dropped in a solution of the poison, causing "violent general tetanic convulsions." Prevost (*Robin's Journal de l'Anatomie*, 1868, p. 209) performed similar experiments, and of course the Frenchman contradicted the German on every point. We include this drug in our observations, as it illustrates how exceedingly cruel the "painless hypodermic injections" may be, though they involve no cutting operations whatever. Professor Wood says "the study of its physiological action shows that its *rational therapeutical use* (note the distinction!) must be limited."—(*Therapeutics*, p. 169.)

Woody Nightshade.—(*Solanum Dulcamara.*)—The extract of this plant when introduced into the stomach of rabbits causes a remarkable degree of apathy with blunted sensibility. It reduces the frequency of the pulse and the respiration, and brings on later, convulsions and death. Dr. John Harley experimented with it on man, without causing any appreciable physiological effect. Whereupon Dr. Stillé (*Therapeutics*, p. 519) makes the following admirable remarks:—"The so-called scientific therapeutists of the present day are disposed to deny any curative virtues to dulcamara, because they are unable to explain those it is alleged to possess, according to their notions of its mode of action. Such a reason may, in a logical sense, be called impertinent. The claims of dulcamara rest on the same grounds as those of opium, mercury, and cinchona, the ground of clinical experience."

M. Duval gave 180 Woody Nightshade berries as well as four ounces of the extract to dogs without producing any effect, yet death is recorded to have been produced by two berries in a child four years old.—(*Woodman and Tidy's Forensic Medicine and Toxicology*, p. 434, 1st Ed.)

Yellow Jasmine.—(*Gelsemium, P. B.*).—Rabbits and cats when poisoned by Gelsemium perform very remarkable backward movements, in which sometimes a complete backward somersault occurs. No corresponding acts have taken place in the fatal cases observed in man. Bartholow says (p. 415) that Ringer and Ott, in an elaborate series of investigations, have confirmed his experimental observations, but he regrets that they were regarded as "inconclusive" by Dr. H. C. Wood.

Dr. Stillé says, p. 676, that "incalculable mischief" has been produced by using this and other drugs "upon no better ground than their power of lowering the pulse and depressing the nervous system." The experimental school of physiologists look upon the animal organism as merely a complicated machine; powerless to solve the mystery of being, they ignore

it and treat its disturbances of function as they would treat a watch or a steam-engine out of order. The stomach is but a superior sort of test tube, the blood vessels mere conduits, and the nerves electric wires, all to be regulated on chemical and mechanical principles; hence the abundant errors and the irreconcileable confusion which have occupied our attention in these pages. What else could have been expected?

I would like to ask "the candid reader" who may have followed me thus far if he really thinks that medical science can make any progress in such a direction as this? Does he honestly think that it is worth while to torture countless thousands of sensitive creatures, to stifle the voice of pity within his breast and to degrade his higher nature by dethroning every sentiment of mercy, merely to attain such results as I have been describing? Putting aside for a moment the consideration of the misleading and confusing nature of the experiments, and the inferences to be drawn from them, let him ask himself what he thinks has been gained by all this cruelty in testing the action of drugs. What has it taught us about opium? What about mercury, quinine, and the other drugs in daily use by every doctor? I firmly believe that our knowledge so far as it concerns the healing of disease has not been advanced one single step by any such means. But suppose it has dowered the medical profession with some boon which I have overlooked or concealed from my readers? I would reply in the words of the poet Coleridge, that "the duties which we owe to our own moral being, are the ground and condition of all other duties; and to set our nature at strife with itself for a good purpose, implies the same sort of prudence as a priest of Diana would have manifested who should have proposed to dig up the celebrated charcoal foundations of the mighty temple of Ephesus, in order to furnish fuel for the burnt offerings on its altars."* If the

* *The Friend* (S. T. Coleridge, p. 20).

great writers on ethics who have denounced this sacrifice of the temple of God which is within us for the paltry boon of a little increase of knowledge are not listened to by those who have the power to arrest the hands of the men of blood, it is certain that nothing which I can say will have any better effect. One lower motive I may appeal to with some hope of success. I have, I venture to think, exposed many of the false pretences of the vivisecting fraternity, and with regard to their claims to the gratitude of suffering humanity have "poured contempt on all their pride." They may have earned the rewards of their learned fellows in medicine and physiology, and decked their brows with the laurels of their Universities. Every profession distributes its own prizes in its own sphere, and the path of the vivisector is perhaps just now the most direct one by which to attain those of the medical profession. They have their reward, and they are welcome to it. Let them be held in honour by those who are participants in their guilt. I would not deprive them of a single leaf of their blood-sprinkled chaplets. What I have aimed at removing is the usurper's crown, stolen from those who have advanced the sciences of medicine and surgery by legitimate and time-honoured means. These false pretenders claim our gratitude and esteem. What sort of title they have to either I trust these pages have shewn.

In my opening paragraphs I quoted from the Inspector's Return relating to experiments on living animals, where he states that of the 280 therapeutical experiments performed under the Act in 1887, some were undertaken "either with the view of justifying the further extension of such remedies to man or of enlarging their present sphere of usefulness." Puzzle—to find the animal on which to try any such remedy for the purpose described!

Other experiments with "some of the old drugs" were undertaken, says Mr. Erichsen, with the view of inquiring "whether their action is such as to justify their continued

administration for the purposes for which they have hitherto been used." Did anybody propose to discard the old drug opium, I wonder, because it had no effect upon pigeons and rabbits? Did anybody propose to discard calomel ——— ? Yes! Professor Rutherford did; but that is a sore subject, and the profession has laughed at him sufficiently ever since. We say no more of that—it is ill flogging a dead horse. Prussic acid is an old drug, and a merciful poison for diseased dogs and cats. Did any wiseacre propose to turn it out of the pharmacies because it has little or no effect on horses and hyænas? Are we to give up belladonna because rabbits eat it without harm? And henbane because it has no effect on sheep, cows, and pigs?

But it is idle to ask Mr. Erichsen any more questions. I believe Mr. Erichsen to be a very learned and a very honourable man; therefore I am equally unwilling to believe that he is not perfectly well acquainted with the whole of the facts which I have collected in these pages, or that he wishes the public to believe that the therapeutical experiments referred to in his report will have any such results as those suggested. My respect and esteem for Mr. Erichsen lead me to think that he knows better; but I wish he had thrown the responsibility for the statements I have quoted on the persons who performed the experiments and had not accepted them himself.

Berdoe

The futility of experiments with drugs on animals.